CoolMaster User Manual

CoolMaster

Universal Interface Adapter

for VRV, VRF

Air Conditioning Systems

CoolMaster 1000D
CoolMaster 2000S
CoolMaster 3000T
CoolMaster 4000M
CoolMaster 7000F
CoolMaster 8000MH
CoolMaster 9000H

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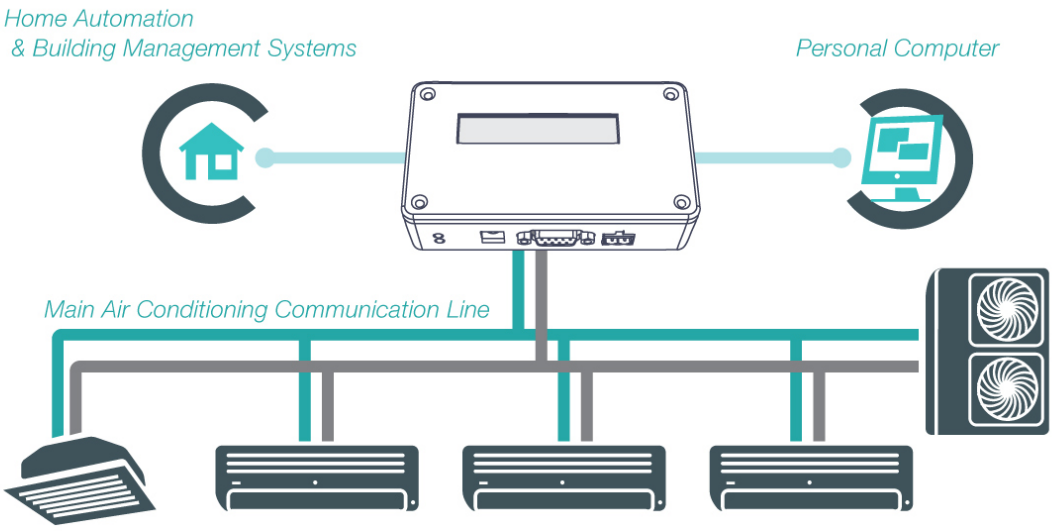
1 General Discription

1.1 Overview

CoolMaster product is a versatile gateway device connecting VRV/VRF Air Conditioning systems to BMS, Embedded PC or any Home Automation Controller. Exposing simple interface over RS232 communication line, CoolMaster provides an access to VRV/VRF system parameters and enables full control and monitoring of the system by the third party equipment. In other words CoolMaster hides complexity of internal Air Conditioning System's communication line (including very unique physical layer) and provides instead a simple, comprehensive, well documented protocol running on popular RS232 serial connection. The product is provided with LCD that continuously indicates the status of indoor units and malfunction alerts. Basic connection of the product within the system can be seen at the following picture.



1.2 Compatibility

The CoolMaster range of products is compatible with several leading VRV/VRF air conditioning systems. Each manufacturer requires different modification of the CoolMaster, as described in the following table.

VRV/VRF Manufacturer	Product Name
Daikin	CoolMaster 1000D
Sanyo	CoolMaster 2000S
Toshiba	CoolMaster 3000T
Mitsubishi Electric	CoolMaster 4000M
Fujitsu	CoolMaster 7000F
Mitsubishi Heavy	CoolMaster 8000MH
Hitachi	CoolMaster 9000H

In VRV/VRF air conditioning system, regardless the specific AC manufacturer, CoolMaster should be connected to the main air conditioning communication line. The specific details about connection to the AC system are provided in Connection and Wiring paragraph.

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Using the CoolMaster with non VRV/VRF systems will require additional interface adaptors for each indoor unit.

VRV/VRF Manufacturer	Product Type	Interface Adaptor
Daikin	Split, Sky Air, Multi	KRP928, DTA112
Mitsubishi Electric	Mr Slim, Multi Split	MAC-399IF-E, PAC-SF80MA
Toshiba	RAV series	TCB-PCNT30TLE2

The detailed description of the connection can be found in Connection to non VRV/VRF Units paragraph.

CoolMaster can be connected to different home automation controllers that have a controllable RS232 port (Vantage, Lite Touch, Unitronics, AMX, Crestron, Pronto, Control4, Domintel, etc), BMS, PC.

1.3 Main Features

- **Simple RS232 Interface for Easy Integration**
- **Monitoring of the Air Conditioning System**
  - Operation Status
  - Operation mode (Cool/Heat/Fan/Dry/Auto)
  - Set Point Temperature
  - Fan Speed
  - Room Temperature
  - Swing status (On/Off)
  - Filter Sign
  - Malfunction code
- **Controlling of the Air Conditioning System**
  - Operation status (On/Off)
  - Operation mode (Cool/Heat/Fan/Dry)
  - Set Point Temperature
  - Fan Speed
  - Reset Filter Sign
  - Swing (On/Off)
- **Plug&Play Device**
- **Field Upgradeable Firmware**
- **Customizable for Specific Applications**

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2 Functional Discription

Simple RS232 Interface for Easy Integration

CoolMaster is equipped with an RS232 serial port. The port can be used in two different ways:

1. Configuration and monitoring of the air conditioning system from PC using simple Windows based terminal program. (See PC connection)
2. Connected to Home Automation controller or BMS.

See Commands List for brief description of supported commands. The complete documentation can be found in Programmers Reference Manual.

Air Conditioning System Monitoring

CoolMaster enables Home Automation controllers or BMS to receive the air conditioning system status. The status is provided by CoolMaster as a response to "stat" command (The syntax and operands of the command can be found in Programmers Reference Manual). CoolMaster can provide following information for each indoor unit in system:

- Operation mode - This parameter indicates whether the required indoor unit is set for Cooling, Heating, Fan, Dry or Auto operation.
  - NOTE
    - The feedback returns the operation mode regardless operation status (whether the unit is "ON" or "Off').
    - Within the same air conditioning system different indoor units can be in different operation mode.
- Set Point Temperature - This is the desired temperature defined by user on the given indoor unit.
- Fan Speed - Currently set fan speed of the monitored indoor unit. There are 4 available Fan Speeds: High, Medium, Low and Automatic.
  - NOTE
    - Sanyo and Toshiba support all 4 Fan Speeds.
    - Most of the Daikin indoor units support only 2 Fan Speeds: High and Low.
    - Some of the new Daikin units (FXDQ-P and FXMQ) support 3 Fan Speeds: High (HH), Medium (H) and Low (L).
- Room Temperature - This is the temperature, measured in the return air inside the monitored indoor unit.
  - NOTE
    - This temperature measurement shows only the temperature inside the indoor unit and it doesn't always indicate correctly the temperature in the room.
- Swing status - This parameter indicates whether the swing operation is "on" or "off" in the monitored indoor unit.
  - NOTE
    - This parameter is only available for wall mounted and cassette type indoor units.
- Filter Sign - Each indoor unit is designed to show a reminder regarding cleaning the filters. After certain number of operation hours the "filter" sign will be shown on the local

remote controller. The time period, after which the sign appears may differ between different types of indoor units.

- Malfunction code - When abnormal operation of the air conditioning system occurs, there will be an indication, regarding the malfunction. The malfunction can be local. In this case the specific indoor unit will be halt and malfunction code will appear on the local thermostat. When the malfunction is general, the whole air conditioning system will stop and the malfunction code will be shown in all local thermostats.
  - NOTE
    - When running "stat" command for a certain indoor unit there might be more than one malfunction code.

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Controlling the Air Conditioning System

- Operation mode - CoolMaster enables Home Automation controllers or BMS to set the operation mode of each indoor unit independently. Cool, Heat, Fan, Dry and Auto operations are possible.
  - NOTE
    - For heat pump air conditioning system Coo" and Heat operation status cannot be set simultaneously for 2 different indoor units. For example, once at least one of the indoors has been set for Cool, all other indoors within the system cannot be set to Heat.
    - In Daikin air conditioning systems one of the indoors can be set as a master for Cool or Heat operation. In this case, Cool or Heat operation of the whole air conditioning system may be carried only by sending the Cool or Heat command to this specific indoor unit. Sending the Cool or Heat command to other indoors will have no effect.
- Operation status - CoolMaster enables Home Automation controllers or BMS to turn indoor units on and off.
- Set Point Temperature - The Set Point Temperature of each indoor unit can be changed separately in two ways:
  1. Defining the desired temperature.
  2. Raising or lowering the existing set temperature by the defined delta.
- Fan Spped - CooMaster enables Home Automation controllers or BMS to change the fan speed of the specified indoor unit.There are 4 available fan speeds: Low, Medium. High and Auto.
  - NOTE
    - Sanyo and Toshiba support all 4 Fan Speeds.
    - Most of the Daikin indoor units support only 2 Fan Speeds: High and Low.
    - Some of the new Daikin units (FXDQ-P and FXMQ) support 3 Fan Speeds: High (HH), Medium (H) and Low (L).
- Reset Filter Sign - Each indoor unit is designed to show a reminder regarding cleaning the filters. After certain number of operation hours the "filter" sign will be shown on the local remote controller. The time period, after which the sign appears may differ between different types of indoor units. CoolMaster enables Home Automation Controllers or BMS to send a command to the system that will reset the filter sign.
- Swing (On/Off) - CoolMaster enables Home Automation Controllers or BMS to change the status of the "Swing" function on each indoor unit from "On" to "Off" and vise versa. Swing function is available on wall mounted and cassette type

Plug&Play Device

When CoolMaster is connected to the air conditioning system, it does not require any additional configuration. After connecting the wiring, supplying the power and defining addresses of the indoor units (as explained in the installation chapter) the system is ready to work.

Field Upgradeable Firmware

When new features are added or some changes has been applied to the CoolMaster's functionality, the firmware of the already installed CoolMaster can be easily upgraded by the user himself. The latest firmware can be always downloaded from http://www.coolaut.com/secdown/ using the following user name and password:
User : cooluser
Password : coolpasswd
The upgrade process is described in details in Programmers Reference Manual.

Customizable for Specific Applications

CoolMaster has a number of optional functions, that can be ordered by demand in order to fit specific customer needs. Example of optional features:

1. Digital/Analog I/O.
2. Connection to the additional devices, such as CoolEx, CoolBridge etc'.

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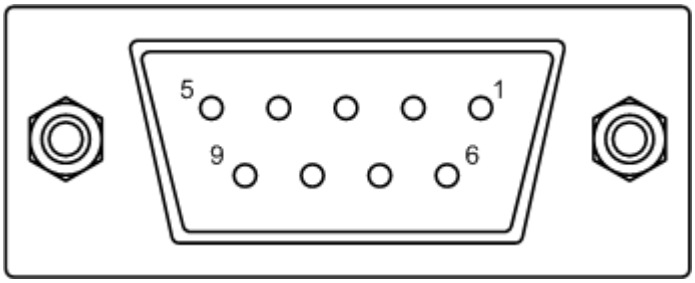
3 Specifications

3.1 Port Definition

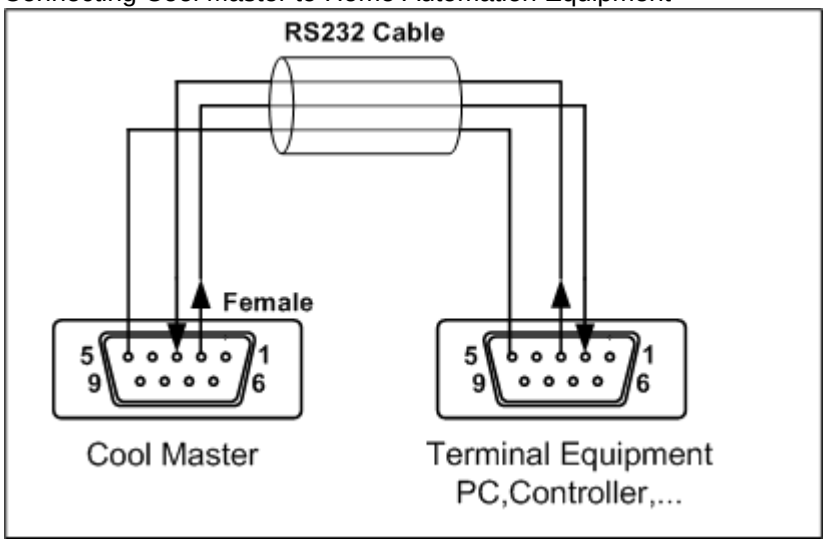
RS232 Interface connector used in Cool Master is D-Type 9-pin DB9 female connector.

Cool Master DB9 Connector front view



DB9 Pin	Signal Lvel	Description
2	±12V	TxD (Data from Cool Master)
3	±12V	RxD (Data to Cool Master)
5	GND	Ground

Connecting Cool Master to Home Automation Equipment



According to RS232 specification cable length should not exceed 25m. RS232 Cable supplied with Cool Master is 1.5m length suitable for direct connection to PC RS232 serial port.

NOTE Please note that for certain controllers it must be required to use cable with cross linked the Transmit(2) and the Receive(3) pins.

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3.2 Technical specification

Item			Specification
Power Supply			9 v DC
Installation Method			Wall Mounted or DIN Rail Mounted
Operating Conditions	Surrounding Temperature	C	0 – 45 °C
	Humidity	%	Less then 85 % RH
Dimensions	H x W x D	mm	30 x 115 x 60
Weight	gr		300
LCD	Characters		16 x 1
Maximal number of indoor units			Depends on the manufacturer
Maximal number of outdoor units			Depends on the manufacturer
Maximal allowable wiring length (to BMS over RS232)		m	25
Communication functions	RS232		9P RS232 Port (Femail Connection)
	Aircon Communication		2 wired cable

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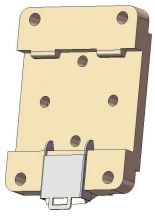
4 Installation Instructions

4.1 Accessories

Standard Accessories
The following accessories are shipped within the kit. The power adaptor can be selected according to domestic AC standards (see Power Supply).

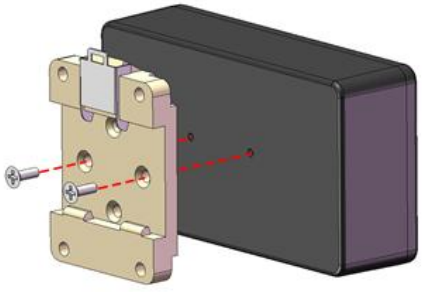
Name	RS232 Cable	Power Adaptor
Quantity	1	1
Shape		

Optional Accessories
The following accessories can be supplied on demand depending on the desired installation location of the CoolMaster.

Name	DIN Rail Fixing	Wall Mounting Plate
Quantity	1	1
Shape		

4.2 Placement and Mounting

The CoolMaster should be placed in a dry ventilated place. It is usually advised to be installed in the electricity closet near the BMS/Home Automation controller since the length of the RS232 connecting cable is limited (see Technical specifications). In this case it is advised to use the optional DIN Rail Fixing, as shown in the following diagrams.



Another option is mounting the CoolMaster directly on wall with Wall Mounting Plate (Accessories).

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4.3 Power Supply

The CoolMaster device requires standard power supply of 9V DC voltage. The power transformer is included in the kit and differs according to the country of the user. Please make sure there is a standard power plug point prepared near the CoolMaster for connection of the power transformer. The supplied types of the power transformer are described in the following table:

AC Parameters	Regions & Countries	Picture
110 - 120 v 60 Hz	USA, Canada, Japan, Mexico, Brazil, South America	
220 - 240 v 50 Hz	United Kingdom	
220 - 240 v 50 Hz	Australia, New Zealand, Asia	
220 - 240 v 50 Hz	Europe, South Africa, Israel, Russia, Hong Kong, India	

NOTE It is not recommended to use a substitutional power adaptor.

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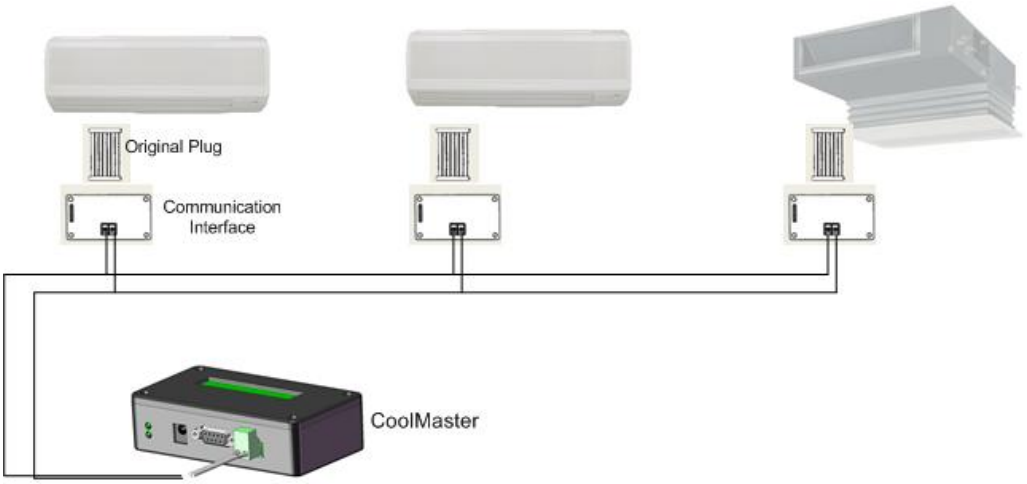
4.4 Connection to non VRV/VRF Units

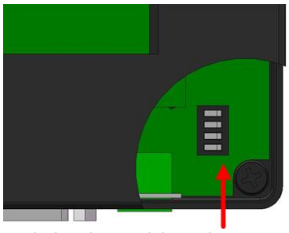
CoolMaster can be used also with split units. In this case each indoor has to be provided with a communication interface (for example, D3 net interface for Daikin Units, M-Net interface for Mitsubishi Electric units, etc'). All those interfaces are plugged into the PCB of the indoor unit (the cable is provided with the interface), and their output has to be inter chained by 2 wired communication line, similarly to the wiring connection of the indoor units in a regular VRV/VRF system. CoolMaster has to be connected to this line, as shown in the following diagram.



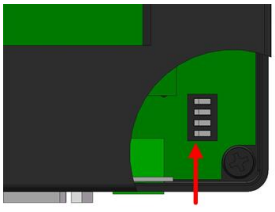
When using the CoolMaster 1000D with KRP928 or DTA102/112 adaptors in Multi/Split/Sky air range of Daikin Air Conditioning systems a change should be made also inside the CoolMaster itself. This change should be made **only** if there is no VRV/Centralized Controller connected to this f1 f2 communication line.

Step1 - Open the top cover of the unit

Step 2 - Change the position of the dip switch (all 4 pins), as shown in the following figure



Original Position (Factory supplied)



New Position

NOTE Please note, that when using CoolMatser with Daikin KRP and DTA D3 net interfaces, the fan speed control and room temperature monitoring is impossible.

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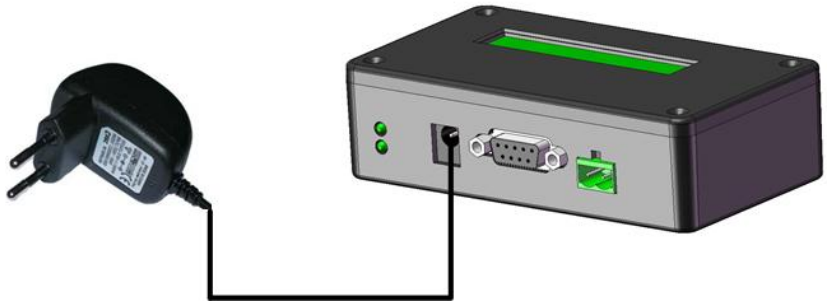
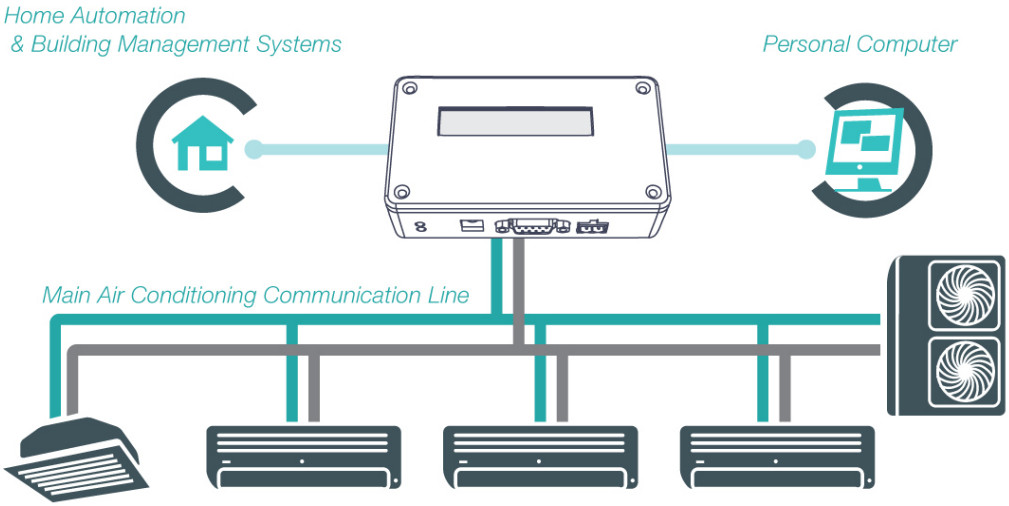
4.5 Connection and Wiring

The connection of the CoolMaster to the system is based on 3 steps:
1. Power supply connection.
2. Connection to the Air Conditioning Communication line.
3. Connection to the BMS/Home Automation controller.

Power Supply connection
The power plug is supplied with the CoolMaster and connected as shown in the following figure.



Connection to the Air Conditioning Communication line
The CoolMaster is simply wired to the Main air conditioning Communication Line anywhere within the system. It can be wired to the terminals on one of the indoor units, directly to the terminals on the outdoor unit or to the terminals on one of the centralized controllers. Schematic connection is shown in the diagram below.



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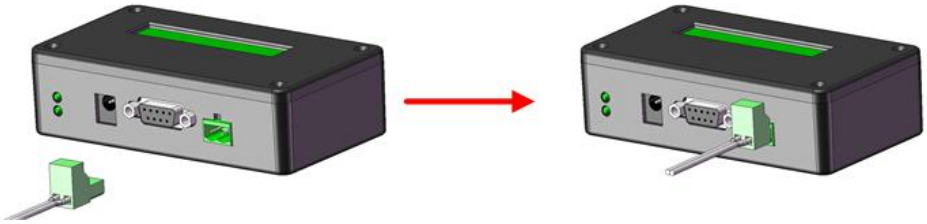
Make sure to connect the communication wires to exact terminal names according to the table below.

	Daikin	Toshiba	Sanyo	Mitsubishi Electric	Fujitsu	Mitsubishi Heavy	Hitachi
Main Communication Line	D3 Net	TCC Link	S3 Net	M-Net (TB3, TB7)	VRF transmission line	Super Link New Super Link	H Link, H Link 2
Terminal names	F1 F2	U1 U2	U1 U2	M1 M2	X1 X2	A B	1 2
Polarity	none	none	none	none	none	none	none
Number of Indoors	64	64	64	50	64	128	64
Number of Outdoors	10	10	10	10	10	10	10
Shielded wiring	not required	required	required	required	required	required	required

The connection to the CoolMaster is performed by a specified plug, as shown in the picture below.



The communication wiring usually consists of two wires with 0.75-1.25 mm2 cross section diameters. The wiring diameters must be the same as the wires used within the air conditioning system, according to the AC manufacturer requirements. The total wiring length within the system should not exceed AC manufacturer limitations. The following table describes the wiring specifications for different manufacturers

Connection to the BMS/Home Automation Controller

The onboard RS232 connector of the CoolMaster is used for configuration, and connection to the BMS/Home Automation controller. The 1.5 m long RS232 Male/female cable is supplied with the CoolMaster.

NOTE
- In order to operate Daikin Air Conditioning systems all the indoor units must be provided with the centralized addresses
- Main Communication Line is defined as the communication line between the indoors and the outdoors.
- Please make sure not to connect the CoolMaster to the communication line between the indoor unit and its local remote controller.

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4.6 Precoutions

Attention

1. During the system automatic operations the CoolMaster must be disconnected from the system. Examples of the automatic operations are:

- Test
- Reset
- Automatic charge

2. Do not change the original positions of the quadruple dip switch SW1 inside CoolMaster when using it with VRV/VRF systems.

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5 User Interface

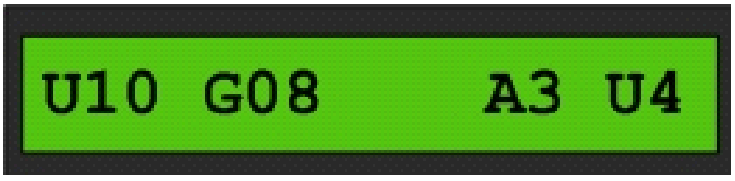
5.1 LCD Screen Explanation

Two types of screens can appear on the LCD of the CoolMaster. One screen shows the indoor units status, as shown in the figure and the explanation table below.

The following table describes what is shown on the LCD Display of the CoolMaster.

Segment Number	Description	Range		Example	
1	Address of the indoor unit	100 - 815		101	
2	Operation Status	"+" - off, "-" - on		"-"	
3	Set Point Temperature	16 - 32		"18"	
4	Fan Speed	Low		high	
		Medium			
		High			
		Auto			
5	Operation Mode	Cool Heat Fan Dry		"Cool"	
6	Filter Sign				
7	Error Status	OK - Normal Opearation U4 - example of malfunction		Ok	

Another screen shows the number of identified indoor units and number of groups



U – Number of recognized indoor units (in the example above – 10)
G – Number of groups (in the example above – 8)
A3 U4 – current malfunction codes in the system

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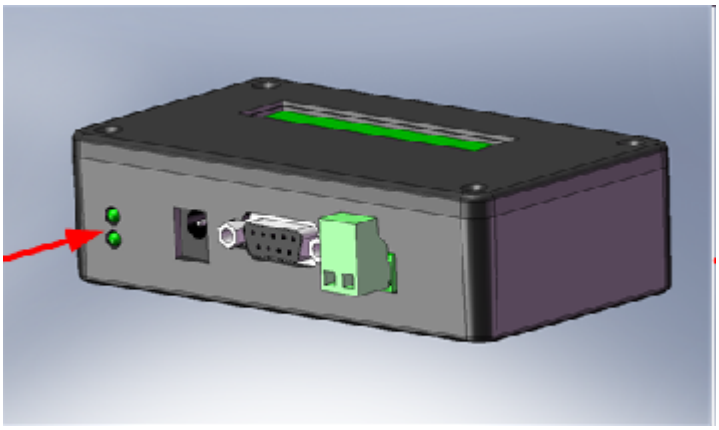
5.2 Led Functions

The unit is equipped with 2 leds, as can be seen in the figure below.



Leds indicate whether there is a communication with the Air Conditioning system. When there is no communication, the upper led is off. When the CoolMatser senses the communication from the Air Conditioning system, the upper led starts blinking. The lower led is currently not functioning.

5.3 PC connection

When the CoolMaster is connected to the air conditioning system it is suggested to check its performance by connecting it to a PC or Laptop.
In order to do so the device has to be connected to the serial PC Port (RS232) or to USB port by using a transformer cable RS232 to USB and appropriate driver.
After the connection, the “Hyper Terminal” program should be engaged, using the following sequence:

Start -> Programs -> Accessories -> Communications -> Hyper Terminal

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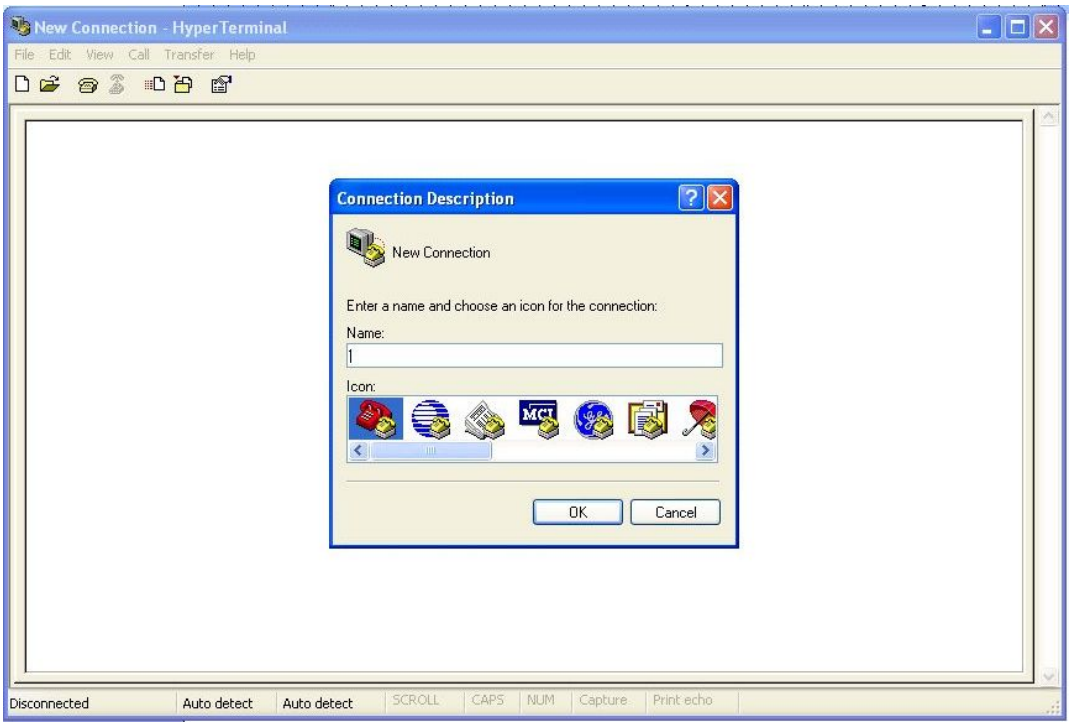

In the opened window “Connection Description” an arbitrary name should be chosen.
Then, in the next window named “Connect to” a correct port has to be chosen at the bottom box, called: “Connect Using:” (for example: modem, com1, com4 etc’).
Next, the port setting has to be defined as following:

Bits per second	9600
Data bits	8
Parity	None
Stop bits	1
Flow control	None

After finishing all those definitions, if everything is correct, the version of the CoolMaster software is

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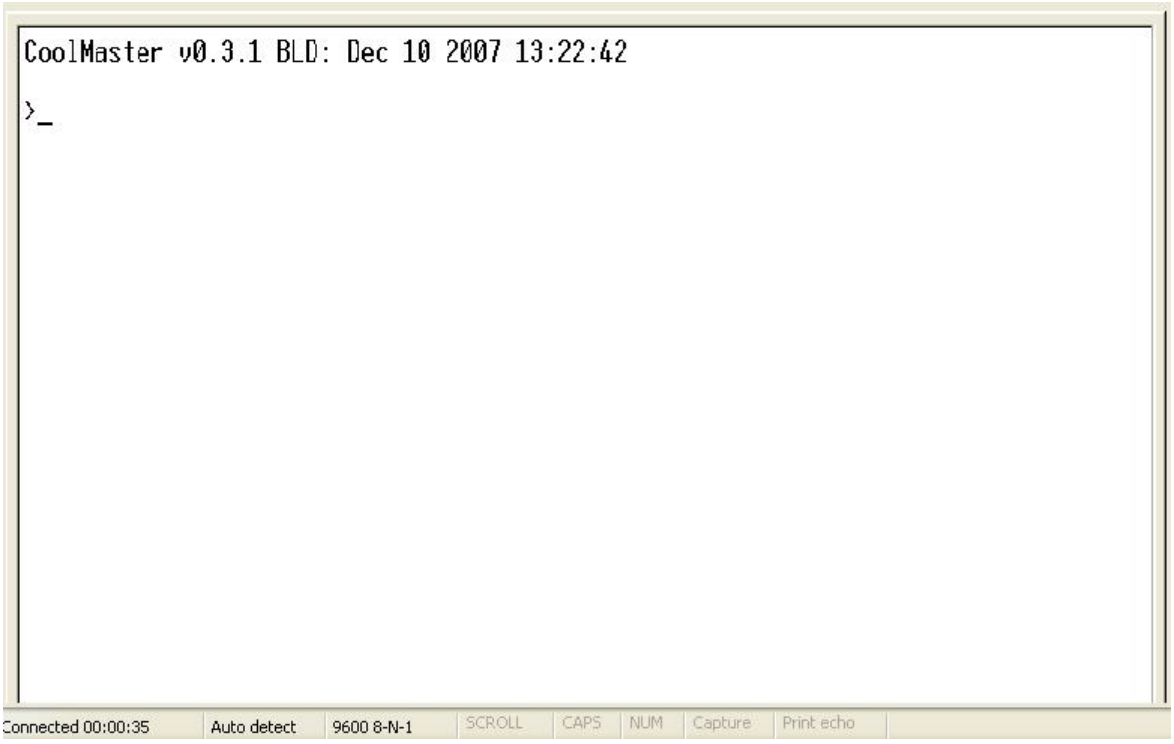
supposed to appear at the top of the window.
At this point all the commands from the command list can be typed and transferred to the air conditioning system.



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5.4 Commands List

on	- on <UID	Turn the unit on
off	- off <UID>	Turn the unit off
temp	- temp <UID> <temp>	Defines the unit's Set Point
cool	- cool <UID>	Turns the system to the cooling mode
heat	- heat <UID>	Turns the system to the heating mode
fan	- fan <UID>	Turns the system to the "Fan" mode
dry	- dry <UID>	Turns the system to the "Dry" mode
auto	- auto <UID>	Turns the system to the "Auto" mode
fspeed	- fspeed <UID> <l|m|h|a>	Sets the unit's fan speed
swing	- swing <UID>	Turns on/off swing operation
stat	-	Prints the status of the all indoor units
stat	- stat <UID>	Prints status of the specified indoor unit
stat2	-	Prints the status of all indoor units (including filter sign)
stat3	-	Prints the status of all indoor units when each parameter has a constant place in the string
set	- set [<echo|myid> <val>	
allon	-	Turns all the indoors on
alloff	-	Turns all the indoors off
boot	-	Runs bootloader
simul	- simul <N>	Simulates the specified number of indoors
filt	-	Resets Filter Sign

NOTE For detailed updated info please refer to the "Programmers reference manual" document.

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6 TroubleShooting

	Symptom	Cause	What to do
1	The LCD of the CoolMaster is off (there is no visible display on it).	**a**. Incorrect power supply	**a**. Check the power adaptor and supplied voltage. Must be stable 9v DC.
2	After connecting the CoolMaster it does not show on its LCD the correct number of indoor units.	**a**. It takes several minutes to recognize the system. **b**. The communication line to the air conditioner is connected improperly.	**a**. Wait for about 5 minutes **b**. Check the connection of the air conditioner communication line. Look if the upper led is blinking. **c**. If the led is off, check the wiring connection of the communication line.
3	The communication does not work (the system does not react to any of your sent commands).	**a**. Improper serial port definitions. **b**. The centralized addresses of the indoor units are not defined. **c**. The wires: transmit and receive of the RS232 cable are not twisted. **d**. Carriage return has not been added to your command.	**a**. Check that all port definitions (baud rate, flow control, parity etc') are properly defined. **b**. Define the centralized addresses of all indoor units. **c**. Check and fix the RS232 cable connection (twisting the Tx and Rx wires). **d**. Add "0d" at the end of the command that is sent to the CoolMaster.
4	The typed commands cannot be seen on the "hyper terminal" screen	**a**. The echo is set to "off".	**a**. Run "echo" command and set "echo" to "On".

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